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Development of Structural Test Articles from Magnesium-Lithium and Beryllium

A study has been concluded which was conducted in two phases: phase one consisted of the fabrication and testing of a magnesium-lithium box beam; phase two involved the forming and testing of various beryllium shrink and stretch flanges.

Phase one proved the formability and machinability characteristics of the magnesium-lithium alloy to be excellent, allowing the use of conventional fabricating and assembly techniques. It was found that the use of a commercially available coating and 5056 rivets was necessary to ensure protection from galvanic corrosion. While it was found that the magnesium-lithium alloy box beam will fail due to plastic buckling of the upper cap at a stress level close to the compressive yield strength of the alloy, it is still optimal among four materials considered.

In phase two the formulation of shrink and stretch flanges was accomplished using the single-action trapped rubber process, well known in airframe part manufacture. However, since beryllium forms well at 1350°F and special grades of rubber can withstand maximum temperature of 700°F, special steps had to be taken. A thin insulating blanket was interposed between the rubber die and beryllium sheet and a relatively fast forming cycle was employed.

Results of the forming tests yielded values for both shrink and stretch flange heights that may be used in future beryllium design. The use of wiper dies, increased press pressure, and improved part lubrication can render the reported values conservative.

Notes:

1. Use of insulation in the trapped-rubber forming process at elevated temperatures makes this a feasible and successful method which could be exploited to good advantage.
2. Requests for further information may be directed to:
Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: TSP69-10417

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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